Part II Mild TBI: New Research and Impact for School-Based SLP's
2009
Bibliography

- http://www.impacttest.com/concussionresource.php
- Burns, M.(2004) Traumatic Brain Injury in Children. *American Speech-Language-Hearing Association Division 1 Newsletter,* Fall, 2004.
- Bilger, E.D. (2007) Anterior and Middle Cranial Fossa in Traumatic Brain Injury. *Neuropschology, **21***(5), 313-331

From sports to the classroom and clinic
•Steelers quarterback Ben Roethlisberger's injury highlights the Impact test 1/2/09
•Former Steelers Mike Webster, Terry Long, and Justin Strzelczyk died before thhe age of 51 – later found to have chronic traumatic encephalography (boxer's dementia)

WHAT IS A CONCUSSION

- A concussion is a disturbance in brain function that occurs following either a blow to the head or as a result of the violent shaking of the head
- In the United States, the annual incidence of sports-related concussion is estimated at 300,000.
  – Estimates regarding the likelihood of an athlete in a contact sport experiencing a concussion may be as high as 19% per season.
  – An unknown number of these individuals may experience chronic cognitive and neurobehavioral difficulties related to recurrent injury.

Common Signs and Symptoms

Signs observed
– Appears to be dazed or stunned
– Is confused about assignment
– Forgets plays
– Is unsure of game, score, or opponent
– Moves clumsily
– Answers questions slowly
– Loses consciousness (even temporarily)
– Shows behavior or personality change
– Forgets events prior to hit (retrograde amnesia)
– Forgets events after hit (anterograde amnesia)

Grades of Concussion
Grade 1:
1. Transient confusion (inattention, inability to maintain a coherent stream of thought and carry out goal-directed movements)
2. No loss of consciousness

3. Concussion symptoms or mental status abnormalities on examination resolve in **less than 15 minutes**

Grade 2:

1. Transient confusion
2. No loss of consciousness
3. Concussion symptoms or mental status abnormalities (including amnesia) on examination last **more than 15 minutes**

Common Signs and Symptoms (continued)

- Signs reported by athlete
  - Headache
  - Nausea
  - Balance problems or dizziness
  - Double or fuzzy vision
  - Sensitivity to light or noise
  - Feeling sluggish
  - Feeling "foggy"
  - Change in sleep pattern
  - Concentration or memory problems

Loss of Consciousness

- In a University of Pittsburgh Medical Center (UPMC) study of high school and college athletes with concussion, on-the-field amnesia, not loss of consciousness, as long thought, was predictive of post-injury symptom severity and neurocognitive deficits.

Sideline Evaluation 1997 (continued)

- *Any appearance of associated symptoms is abnormal, e.g., headaches, dizziness, nausea, unsteadiness, photophobia, blurred or double vision, emotional lability, or mental status changes.*

- *For more information about the Management of Concussion in Sports Public Education Campaign, please call the Brain Injury Association at (703) 236-6000 .*
- *To order more palm cards call (800) 321-7037.*

Loss of Consciousness (continued)

- LOC is relatively rare and occurs in less than 10% of concussive injuries.
- The identification of LOC can be very tricky as the athlete may lose consciousness very briefly, and this event may not be directly observed by others.
  - By definition, LOC represents a state of brief coma in which the eyes are typically closed and the athlete is unresponsive to external stimuli.
  - LOC is most obvious when an athlete makes no attempt to brace his or her fall following a blow to the head.
- **Any athlete with documented LOC should be managed conservatively, and return to play is contraindicated.**

Post Concussion Syndrome

- Symptoms may include
  - chronic headaches,
  - fatigue,
  - sleep difficulties,
  - personality change (e.g. increased irritability, emotionality), sensitivity to light/noise,
  - dizziness when standing quickly,
  - and deficits in short-term memory, problem solving and general academic functioning.
- It can be quite disabling for an athlete.
- In some cases, such difficulties can be permanent and disabling.

Second Impact Syndrome

- In addition to Post-Concussion Syndrome, suffering a second blow to the head while recovering from an initial concussion can have catastrophic consequences as in the case of "Second Impact Syndrome,"
- This has led to approximately 30-40 deaths over the past decade.

The Prefrontal Cortex: Functional Neural Development During Early Childhood

- Satoshi Tsujimoto
- *Neuroscientist* 2008; 14; 345 originally published online May 8, 2008

Tsujimoto

- Development of the prefrontal cortex during early childhood
  - **Structural Architecture:** Neuroanatomically, the prefrontal cortex undergoes considerable maturation during childhood, including a reduction of synaptic and neuronal density, a growth of dendrites, and an increase in white matter volume, thereby forming distributed neural networks appropriate for complex cognitive processing.
  - **Cognitive Abilities:** Concurrently, behavioral performance of various cognitive tasks improves with age, and intercorrelations among performance on each task become weak through development.
  - Furthermore, the correlation between subcategories of intelligence test decreases as general intellectual efficiency increases.
  - **Neural Activity:** recent neuroimaging findings suggest that the prefrontal cortex is already functional in 4-year olds and becomes organized into focal, fine-tuned systems through later development.
- The literature reviewed suggests that fractionation of the functional neural systems plays a key role in the development of prefrontal cortex and such fractionating process has already commenced in preschool children.

IMPACT TEST

- Available for schools and sports teams to pre-test athletes and monitor post-concussion symptoms

•http://www.impacttest.com/concussionresource.php

Implications for clinic and classroom

•Any child who has suffered a concussion at school or at home should:

–Be assessed for cognitive limitations and monitored regularly

–Be assisted with symptoms like frustration intolerance, explosive anger, attentional disorders

–Receive support services as necessary for executive function and memory impairments that could affect school achievement

Mechanisms of TBI: Primary Lesions

•Diffuse

– axonal injury - shearing strains

•Focal

–contusions - bruises

–lacerations - tears and cuts

–coup and contre-coup lesions

Secondary Lesions

•Diffuse (see CT scan slides)
–Cerebral edema
–Raised intracranial pressure
–Ischemia
–Brain shift and herniation
–Cerebral atrophy and ventricular enlargement

•Focal - hemorrhages/hematomae (CT scans)
–extradural (epidural); subdural; intracerebral

Commonly used Neuropsych batteries

•Children

Children's Memory Scale™ (CMS) Morris Cohen

identify deficits in learning and memory,
deficient recall strategies, and underlying processing disorders.
design remedial programs based upon the child's strengths and compensatory strategies to help the child circumvent his/her weaknesses

California Verbal Learning Test® —Second Edition (CVLT® –II) Dean C. Delis, Joel H. Kramer, Edith Kaplan, Beth A. Ober
•comprehensive and detailed assessment of verbal learning and memory
•for older adolescents and adults
•read a list of words,
•ask to recall them across a series of trials
Mild TBI Treatment approaches

- Attention/concentration
- Working memory
- Executive function
- Behavior impairments
- Family rehabilitation

Other treatment considerations

- Problems specific to damage associated with pediatric head trauma

–Working memory and processing speed
–Problems associated with subcortical shearing strains and focal coup and contre-coup lesions
Students with Closed Head Injuries vs Students with Learning Disabilities
Neural mechanisms of selective auditory attention are enhanced by computerized training: Electrophysiological evidence from language-impaired and typically developing children

- Courtney Stevens,, Jessica Fanning, Donna Coch,, Lisa Sandersa,, Helen Neville B R A I N R E S E A R C H 1 2 0 5 (2 0 0 8) 5 5 – 6 9

Counting span task

- Selective attention – inhibition of yellow dots
- Holding information in mind while executing another mental option
- Updating the information held in mind on each trial
- Temporal order memory

Please count the number of blue dots aloud?
Please count the number of blue dots aloud
Please count the number of blue dots aloud

Development of Social Competence

•Signs of social competence develop during early infancy, so that by approximately 12 months of age infants can ascribe agency to a system or entity

•Agency - The capacity of an individual to make conscious choices and impose those choices on the world.

Medications and how they work
•**Stimulants**: methylphenidate HCL
–Ritalin & Methylin – approved for children 6 and older – oldest, most reliable
–Methylphenidate osmotic controlled release – Concerta
•**Atomoxetine**: Selective norepinephrine reuptake inhibitor – increases frontal dopamine and norepinephrine
–Strattera – extensive premarket testing – newest ADHD drug available
•**Amphetamines**
–Adderall – stimulant, once a day, can become addictive
–Dexedrine- same
•**SSRIs** – suicidal warnings in adolescents
–Prozac
–Zolaft
–Paxil

Medications and how they work (cont.)
•Targets for bipolar disorders
–Lithium
–Depakote (antiseizure)
–Zyprexa – balances serotonin and dopamine
•Antidepressants
–Wellbutrin – 3-4 times a day, enahances norepinephrine and to a lesser extent Dopamine
•Others
–Cylert – nonaddictive but hepatoxic (liver)
–Tofranil (antidepressant) requires baseline and follow-up electrocardiograms for arrhythmia
–Norpramin – similar to Tofranil